## Tabulation and evaluation of upstream actions by game

| Game | Water yr. | Month | Action | Volume (TAF) Sacramento | Volume (TAF) San Joaquin | Qualitative evaluation |
|---|---|---|---|---|---|---|
| 2 | 1991 | Apr | San Joaquin market release | | 30 | Extend and expedite smolt emigration. |
| | | Aug | Water quality release | 30 | | Assume Yuba releases; could provide minor temperature and habitat area benefits |
| | | Sep | Water quality release | 30 | | for chinook salmon and steelhead. |
| | 1992 | Oct | Sacramento R. market release | 50 | | Hydrograph smoothing**, increased spawning area. |
| | | Oct | San Joaquin market release | | 35 | Attraction flow benefit |
| | | Oct | Water quality release | 30 | | Assume Yuba releases; could provide minor temperature and habitat area benefits for steelhead |
| | | Nov | Sacramento R. market release | 50 | | Hydrograph smoothing, increased spawning area extent; expedite yearling emigration |
| | | Nov | San Joaquin market release | | 35 | Attraction flow benefit; improved spawning conditions |
| | | Mar | San Joaquin market release | | 60 | Primarily for winter run and splittail protection in Delta |
| | | Mar | San Joaquin market release | | 40 | Expedite early smolt emigration. |
| * | | Aug | Water quality release | 30 | | Assume Yuba releases; could provide minor temperature and habitat area benefits |
| * | | Sep | Water quality release | 30 | | for chinook salmon and steelhead. |
| | 1993 | Oct | Sacramento R. market release | 33 | | Hydrograph smoothing, increased spawning area. |
| | | Nov | Sacramento R. market release | 33 | | Hydrograph smoothing, increased spawning area. |
| | | Mar | Shasta (backing water) | -25 | | Historic Keswick release about 4000 cfs below long-term average; minor adverse effects |
| | | Jul | Shasta release | 50 | | Temperature and habitat area benefits for winter run, yearlings, and steelhead. |
| | | Jul | Sacramento R. market release | 100 | | Temperature and habitat area benefits for winter run, yearlings, and steelhead. |
| | | Jul | San Joaquin market release | | 100 | Temperature and habitat area benefits for steelhead. |
| | 1994 | Apr | San Joaquin market release | | 60 | Extend and expedite smolt emigration. |
| | | *Jun* | *San Joaquin market release* | | 40 | *Extend and expedite smolt emigration.* |
| | | Aug | Shasta (backing water) | -20 | | Nearly average base release; negligible adverse effect. |
| | | Aug | Water quality release | 30 | | Assume Yuba release; minor temperature and habitat area benefits for steelhead |
| | | Aug | Sacramento R. market release | 50 | | Temperature and habitat area benefits. |
| | | Sep | Shasta release | 20 | | Minor temperature and habitat area benefits |
| | | Sep | Sacramento R. market release | 17 | | Minor temperature and habitat area benefits |
| | 1995 | Oct | Sacramento R. market release | 17 | | Hydrograph smoothing, increased spawning area. |
| | | Oct | Water quality release | 30 | | Hydrograph smoothing, increased spawning area. |
| | | Nov | Sacramento R. market release | 17 | | Hydrograph smoothing, increased spawning area. |
| | | Jan | Shasta (backing water) | -50 | | Large outflow event; negligible adverse effect. |

| Game | Water yr. | Month | Action | Volume (TAF) Sacramento | Volume (TAF) San Joaquin | Qualitative evaluation |
|---|---|---|---|---|---|---|
| 4 | 1991 | Apr | San Joaquin market release | | 14 | Early VAMP; expedite smolt emigration. |
| | 1992 | Oct | San Joaquin market release | | 28.6 | Primarily moved to EWA SOD storage -- |
| | | Nov | San Joaquin market release | | 28.6 | some chinook salmon benefit |
| | | Dec | San Joaquin market release | | 28.6 | as attraction flow for adults. |
| | | Mar | San Joaquin market release | | 60 | Extend and expedite smolt emigration. |
| | 1993 | Oct | San Joaquin market release | | 13 | Primarily moved to EWA SOD storage -- |
| | | Nov | San Joaquin market release | | 13 | some chinook salmon benefit |
| | | Dec | San Joaquin market release | | 13 | as attraction flow for adults. |
| | | Mar | Shasta (backing water) | -60 | | Historic Keswick release about 4000 cfs below long-term average; minor adverse effects. |
| | | Aug | Shasta release | 60 | | Primarily moved to EWA SOD storage -- minor temperature benefit for chinook salmon |
| | | Aug | San Joaquin market release | | 50 | Primarily moved to EWA SOD storage -- |
| | 1994 | Mar | San Joaquin market release | | 60 | Extend and expedite smolt emigration. |
| | | Mar | Folsom (backing water) | -30 | | Possible stranding, protracted emigration |
| | | Apr | San Joaquin market release | | 60 | Extend and expedite smolt emigration. |
| * | 1995 | Jan | Shasta (backing water) | -50 | | Large outflow event; negligible adverse effect. |
| * | | Jan | Folsom release | 120 | | Expedite fall run fry movement to Delta; may not be a benefit. |

| Game | Water yr. | Month | Action | Volume (TAF) Sacramento | San Joaquin | Qualitative evaluation |
|---|---|---|---|---|---|---|
| 5 | 1991 | Apr | San Joaquin market release | | 14 | Extend and expedite smolt emigration. |
| | | May | San Joaquin market release | | 15 | Extend and expedite smolt emigration. |
| | | July | Folsom (backing water) | -33.3 | | Reduced steelhead habitat; saving water for fall chinook |
| | | Aug | Folsom (backing water) | -33.3 | | Reduced steelhead habitat; saving water for fall chinook |
| | | Sep | Folsom (backing water) | -33.3 | | Reduced steelhead habitat; saving water for fall chinook |
| * | 1992 | Oct | Folsom release | 60 | | Releases to smooth hydrographs; |
| | | Oct | San Joaquin release | | 24 | attraction, spawning, and incubation benefits |
| | | Nov | Folsom release | 60 | | |
| | | Nov | San Joaquin release | | 24 | |
| | | Dec | Folsom release | 60 | | |
| | | Dec | San Joaquin release | | 23 | |
| | | Apr | San Joaquin market release | | 30 | Extend and expedite smolt emigration. |
| | | Jul | Sacramento R. market release | 62 | | Temperature and habitat area benefit. |
| | 1993 | Oct | Sacramento R. release | 38 | | Hydrograph smoothing, increased spawning area. |
| * | | Apr | Shasta (backing water) | -50 | | |
| * | | Jul | Shasta release | 100 | | Temperature benefit |
| | | Jul | Oroville release | 50 | | Minor temp. and hab. area benefits for over-summering juv. chinook and steelhead. |
| | | Jul | San Joaquin release | | 120 | Possible steelhead benefits; temp. control |
| | | Aug | Shasta release | 60 | | Temperature benefit. |
| | | Sep | Shasta release | 120 | | Minor temperature benefit; hydrograph smoothing |
| | 1994 | Dec | Shasta (backing water) | -115 | | Minor redd dewatering risk |
| | | Mar | San Joaquin market release | | 50 | Primarily to protect WR in Delta; minor WQ and habitat quantity benefits for SJ juveniles. |
| | | Apr | San Joaquin market release | | 50 | Extend and expedite smolt emigration. |
| | | Apr | Shasta (backing water) | -100 | | Base release 2000 cfs below avg., but above AFRP recommended flow; |
| | | May | Shasta (backing water) | -60 | | minor adverse effect on emigrant smolts, possible adult delay |
| | | Aug | Shasta release | 45 | | Temperature benefit. |
| * | 1995 | Feb | Shasta (backing water) | -50 | | Large outflow event; negligible adverse effect. |

* Game spreadsheet and notes do not agree; generally accepted notes as capturing intended application of the EWA.

** "Hydrograph smoothing" or control means that releases were intended to fill in troughs in the hydrograph that could lead to adverse spawning conditions, redd dewatering, or juvenile stranding.

Upstream benefits for splittail resulting from increased flow, such as increased floodplain inundation area or inundation duration, are also possible.

# Upstream Benefit Summary

(Volumes in TAF)

## Sacramento Basin

Type of upstream benefit

| Game | Year | Temp. control | Hydrograph control | Total |
|---|---|---|---|---|
| *2 | 1991 | 60 | | 60 |
| | 1992 | 90 | 100 | 190 |
| | 1993 | 150 | 66 | 216 |
| | 1994 | 117 | | 117 |
| | 1995 | | 64 | 64 |
| | Total | 417 | 230 | 647 |
| 4 | 1991 | 60 | | 60 |
| | 1992 | | | 0 |
| | 1993 | | | 0 |
| | 1994 | | | 0 |
| | 1995 | | 120 | 120 |
| | Total | 60 | 120 | 180 |
| **5 | 1991 | | | 0 |
| | 1992 | 62 | 180 | 242 |
| | 1993 | 330 | 38 | 368 |
| | 1994 | 45 | | 45 |
| | 1995 | | | 0 |
| | Total | 437 | 218 | 655 |
| | Grand mean | | | ~100 |
| | Std. Dev. | | | 110 |

* This game included water quality releases and new facilities anticipated by the middle of Stage 1.

** Extensive backing of water into Shasta, Folsom, and Oroville may have resulted in adverse effects.

For comparison, the AFRP annual acquisition goal for instream fishery habitat ranged from 0 to 100 TAF across alternatives, with no quantified amount for nine tributaries (CVPIA draft PEIS 1997, pg. II-30). This does not include b(1) or b(2) water.

Since 1994, AFRP upstream purchases have ranged from 8 to 68 TAF.

# Upstream Benefit Summary

(Volumes in TAF)

## San Joaquin Basin

Type of upstream benefit

| Game | Year | Smolt emigration | Attraction flow | Temp. control | Total |
|---|---|---|---|---|---|
| *2 | 1991 | 30 | | | 30 |
| | 1992 | 100 | 70 | | 170 |
| | 1993 | | | 100 | 100 |
| | 1994 | 100 | | | 100 |
| | 1995 | | | | 0 |
| | Total | 230 | 70 | 100 | 400 |
| 4 | 1991 | 14 | | | 14 |
| | 1992 | 60 | 86 | | 146 |
| | 1993 | | 39 | 50 | 89 |
| | 1994 | 120 | | | 120 |
| | 1995 | | | | 0 |
| | Total | 194 | 125 | 50 | 369 |
| **5 | 1991 | 29 | | | 29 |
| | 1992 | 30 | 71 | | 101 |
| | 1993 | | | 120 | 120 |
| | 1994 | 100 | | | 100 |
| | 1995 | | | | 0 |
| | Total | 159 | 71 | 120 | 350 |
| Grand mean | | | | | ~75 |
| Std. Dev. | | | | | 57 |

* This game included water quality releases and new facilities anticipated by the middle of Stage 1.

** Extensive backing of water into Shasta, Folsom, and Oroville may have resulted in adverse effects.

For comparison, the AFRP annual acquisition goal for instream fishery habitat ranged from 170 to 710 TAF across alternatives (CVPIA draft PEIS 1997, pg. II-30). This does not include b(1) or b(2) water.

Since 1994, AFRP upstream purchases have ranged from 30 to 150 TAF.

## "Angst factor" summary

| Year | Winter-run | Spring-run | | | Fall-run | | | |
|---|---|---|---|---|---|---|---|---|
| | | Deer | Mill | Butte | Sacramento | American | Stanislaus | Tuolumne |
| 1991 | 0.08 | 0.55 | 0.24 | 0.42 | 0.62 | 0.44 | 0.21 | 0.06 |
| 1992 | 0.07 | 0.60 | 0.23 | 0.54 | 0.57 | 0.53 | 0.15 | 0.05 |
| 1993 | 0.05 | 0.45 | 0.23 | 0.45 | 0.56 | 0.72 | 0.14 | 0.06 |
| 1994 | 0.04 | 0.46 | 0.31 | 0.40 | 0.61 | 1.00 | 0.16 | 0.12 |
| 1995 | 0.05 | 0.39 | 0.37 | 0.80 | 0.65 | 1.19 | 0.18 | 0.21 |

Click on cell A-13 for an explanative comment on how these factors were derived.